

REMARKS

I. Status of the Application

Claims 1-55 are pending in this application. Claims 4-15, 18, 25-26, 31, 45-47 have been withdrawn as directed to non-elected species.

The specification is objected to as failing to provide proper antecedent basis for claims 50 and 51. As discussed below, the specification has been amended to correct this. No new matter has been added by virtue of the amendments made to the specification.

Specifically, Applicant has amended page 43, line 18, and page 45, heading of Table 7 of the specification to describe the term “internal validation” from claim 50 as “self prediction and cross validation (methods for internal validation).” Support for this amendment can be found in claim 51, and on page 28, last paragraph. Applicant has also amended page 43 of the specification to include step (7) of claim 51, which is part of the original filing so is not new matter.

Claims 1-55 stand provisionally rejected under nonstatutory obviousness-type double patenting as being unpatentable over claims 1-34 of co-pending application 10/621,079. A Terminal Disclaimer over that application is included with this filing. Accordingly, this provisional rejection may now be withdrawn. Such action is respectfully requested.

Claims 1, 16, 17 and 19-24 stand rejected under 35 U.S.C. § 102(a) as being anticipated by Richards et al. “Optimisation of a Neural Network Model for Calibration of Voltammetric Data,” *Chemometrics and Intelligent Laboratory Systems*, 61, 2002, p.

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35-49. For reasons provided below, this rejection is respectfully traversed.

Claims 2, 3 and 53 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Richards et al. For reasons provided below, this rejection is respectfully traversed.

Claims 27-44, 48-49 and 54-55 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Richards et al. in view of Applicant's admission of prior art. For reasons provided below, this rejection is respectfully traversed.

Claims 50-52 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Richards et al. and Applicant's admission of prior art as applied to claim 27, and further in view of Schneider "Cross Validation," February 1997,

<http://www.cs.cmu.edu/~schneide/tut5/node42.html>.

For reasons provided below, this rejection is respectfully traversed.

Applicant has amended the claims to more clearly define and distinctly characterize the invention. Specifically, independent claims 1, 27, 53 and 54 have been amended to more distinctly characterize the electrolyte solution. Support for these amendments can be found either explicitly or inherently in the specification at Table 1, page 18, second to last paragraph, and page 20, first paragraph. Claim 22 has been amended to more clearly define the electroanalytical response combination. Support for this amendment can be found on page 44, last paragraph to page 45, first paragraph of the specification, and in Table 7. Claims 16, 19-21, 23, 24, 29, 32, 34-38, 40-42 and 48-52 have been amended to correct formal matters.

The amendments presented herein add no new matter. Applicant submits that the

amendments presented herein do not raise new issues requiring further search. Applicant respectfully requests entry and consideration of the foregoing amendments and reconsideration of the application in view of the following remarks, which are intended to place this case in condition for allowance.

II. Election in Response to Restriction Requirement

On page 2, paragraph 1 of the instant Office Action, claims 4-15, 18, 25-26, 31, 45-47 stand withdrawn as directed to non-elected species. Applicant acknowledges and appreciates the Examiner's assistance regarding the same.

III. Claim Objections

On page 2, paragraph 4 of the instant Office Action, the specification stands objected to as failing to provide proper antecedent basis for claims 50 and 51. Applicant has amended page 43, line 18, and page 45, heading of Table 7 of the specification to state "self prediction and cross validation (methods for internal validation)," thereby defining "internal validation." Applicant submits that the specification does provide antecedent support for the steps of claim 51. Pages 28, last paragraph to page 33, first paragraph lists steps for Mahalanobis Distance coupled with PCA validation. Bottom of page 33 to top of page 34 lists steps for SIMCA cross validation. Page 41 lists steps for cross-validated leverages. All of these methods correspond to steps (1) – (5) of claim 51. Page 43 describes obtaining $(r^o)^2$ values for cross validation calculated from original actual concentrations and rescaled predicted concentrations, corresponding to step (6) of claim 51. Step (7) of claim 51 has been amended into page 43 of the specification to provide antecedent support.

Thus claims 50 and 51 have antecedent basis in the specification. Accordingly,

Applicant respectfully requests withdrawal of the objection and allowance of claims 50 and 51.

IV. Provisional Obviousness-Type Double Patenting

On page 3, paragraph 6 of the instant Office Action, claims 1-55 stand provisionally rejected on the grounds of non-statutory obviousness-type double patenting as being unpatentable over claims 1-34 of co-pending U.S. patent application 10/621,079. Applicant is providing a terminal disclaimer over the subject application to obviate this rejection.

V. Claims 1, 16, 17 and 19-24 are Novel over Richards et al.

On page 4, paragraph 8 of the instant Office Action, claims 1, 16, 17 and 19-24 stand rejected under 35 U.S.C. § 102(a) as being anticipated by Richards et al. “Optimisation of a Neural Network Model for Calibration of Voltammetric Data,” *Chemometrics and Intelligent Laboratory Systems*, 61, 2002, p. 35-49 (“Richards”). The Examiner is of the opinion that Richards teaches each and every element of the rejected claims. Applicant respectfully traverses this rejection.

Applicant’s invention is directed to a process to produce a predictive data set which can be used to predict the amount of target constituent in an electrolyte solution, said process comprising: (a) providing a multi-component electrolyte solution comprising constituents which possess significantly different electrochemical properties, said constituents being present in the electrolyte solution at concentrations significantly different from each other, said constituents interacting electrochemically with each other in the electrolyte solution; (b) obtaining a sample set, wherein each sample of the sample set comprises an electrolyte solution of step (a) with known composition; (c) obtaining an

electroanalytical response for each said sample to produce a electroanalytical response data set; (d) obtaining a training set that comprises said sample set and the corresponding said electroanalytical response data set; (e) analyzing said training set using decomposition and multivariate regression method to produce a regression data set; and (f) validating said training data set to produce said predictive data set for a predictive calibration model.

The electrolyte solution of Richards is a simple mixture of aliphatic compounds, namely ethanol, fructose and glucose (page 36, 2nd column, paragraph “2. Experimental”). One of ordinary skill in the art would expect fructose and glucose, both being sugars, to possess very similar electrochemical properties. The electrochemical properties of ethanol should be similar to those of fructose and glucose because they are all aliphatic compounds possessing hydroxyl functional groups. Thus, Richards does not teach an electrolyte solution comprising constituents which possess **significantly different** electrochemical properties as required by step (a) of amended claim 1. In contrast, Applicant’s electrolyte solutions consist of inorganic and organic components (specification page 18, 5th paragraph, and Table 1), which do possess significantly different electrochemical properties.

The constituents in Richards’ electrolyte solution are present at similar concentrations in the μM to mM range (page 36, 2nd column, paragraph “2. Experimental”). Thus, Richards does not teach an electrolyte solution comprising constituents present at **significantly different** concentrations as required by step (a) of amended claim 1. In contrast, Applicant’s electrolyte solutions comprise constituents present at concentrations differing from each other by several orders of magnitude (Specification, Table 1).

The constituents of Richards’ electrolyte solution do not chemically interact with

each other. Therefore, their respective electroanalytical signals are independent of each other. Thus, Richards does not teach an electrolyte solution comprising constituents interacting electrochemically with each other as required by step (a) of amended claim 1. In contrast, the constituents in Applicant's electrolyte solutions comprise very different chemical species (Table 1), and these do chemically interact with each other, at the electrode surface, by forming complexes and/or intermediate species. The electroanalytical signals of the constituents are interdependent upon each other, since surface chemical processes change the electrochemical properties of the individual constituents.

Amended claim 22 recites a novel method of information enhancement by simultaneous decomposition of data for various voltammetric curves obtained for the same sample. This method is called "gluing" of voltammograms and is presented in Table 7 of the specification. Richards uses only one type of voltammetric curve obtained from one analytical technique per sample, and is therefore prone to bias and other disadvantages of the chosen voltammetric approach. One can obtain information significantly free of bias if one simultaneously uses information from more than one approach. As Richards did not use AC voltammetry coupled with multivariate analysis, Richards could not benefit from gluing to any large extent. Amended claim 22 recites a training data set based on the combined results obtained using different independent analytical techniques (e.g. a region of AC voltammogram and two regions of DC voltammogram). This is not taught by Richards.

For the above reasons, Richards does not teach each and every element of independent claim 1 and its dependent claims. Accordingly, Applicant respectfully requests withdrawal of the 35 U.S.C. § 102(a) rejection and allowance of claims 1, 16-17 and 19-24.

VI. Claims 2, 3 and 53 are Not Obvious over Richards et al.

On page 5, paragraph 10 of the instant Office Action, claims 2, 3 and 53 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Richards et al. “Optimisation of a Neural Network Model for Calibration of Voltammetric Data,” *Chemometrics and Intelligent Laboratory Systems*, 61, 2002, p. 35-49 (“Richards”). The Examiner is of the opinion that the claim limitations are obvious in view of Richards.

Applicant respectfully traverses the rejection as failing to set forth a *prima facie* case of obviousness.

A *prima facie* case of obviousness requires three showings:

First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant’s disclosure.

Manual of Patent Examining Procedure, 8th ed., § 2142. These requirements of a *prima facie* case of obviousness are not met for any of the following rejections under 35 U.S.C. § 103(a).

As submitted in section V above, Richards does not teach or suggest all of the

limitations of amended claim 1. Since dependent claims incorporate the subject matter of the claims they depend from, Richards does not teach or suggest all the limitations of dependent claims 2 and 3. Also, Richards in no way suggests the desirability of using the described neural network model to calibrate voltammetric data acquired from anything other than mixtures of aliphatic compounds. Richards does not teach in the art field of electroplating. Richards utilizes as model systems mixtures of components that possess similar electrochemical properties, are present at similar concentrations, and do not interact with each other. The electroanalytical signals of Richards' solution components are independent from each other, and thus are additive, i.e. the algebraic sum of individual voltammograms can recreate a voltammogram obtained from the mixture of constituents. Richards is directed to removing interference, caused by the overlapping independent signals of other components, from the electroanalytical signal of interest, in a solution where the components do not chemically interact with each other.

One skilled in the art of electroplating would not look with any expectation of success to Richards for a method to calibrate voltammetric data from electroplating baths containing interacting constituents of different chemical natures present at concentration levels that differ by several orders of magnitude, as recited by claims 2 and 3.

Electroplating baths contain metals interacting with ligands to form complexes, and so their constituents possess significantly different and interdependent electrochemical properties, also recited by claims 2 and 3. Therefore, neither Richards nor common knowledge to one skilled in the art of electroplating provides motivation to combine teachings to arrive at the methods of claims 2 and 3 with a reasonable expectation of success.

Claim 53 has been amended to recite "(a1) providing a multi-component electrolyte solution comprising constituents which possess different electrochemical properties, said constituents being present in the electrolyte solution at concentrations

significantly different from each other, said constituents interacting electrochemically with each other in the electrolyte solution.” As submitted in section V above, Richards does not teach or suggest this claim limitation. The Examiner admits that Richards does not teach a method to predict the concentration of a target constituent. Claim 53 has also been amended to recite “(b1) obtaining an unknown sample set, wherein each unknown sample in said unknown sample set contains an electrolyte solution of step (a1).” Richards in no way suggests the desirability of using the described neural network model to predict unknown concentrations of aliphatic constituents, much less the constituents of electrolyte solution (a1) in claim 53. Therefore, one skilled in the art would not be motivated to apply the method of Richards to predict target constituent concentrations in electrolyte solution (a1) with any reasonable expectation of success.

Richards cannot support a *prima facie* case of obviousness, because Richards does not provide suggestion or motivation to modify the reference with a reasonable expectation of success, nor does Richards teach or suggest all the claim limitations. Accordingly, Applicant respectfully requests withdrawal of the 35 U.S.C. § 103(a) rejection and allowance of claims 2, 3 and 53.

VII. Claims 27-44, 48-49 and 54-55 are Not Obvious over Richards et al. in view of Applicant’s admission of prior art

On page 6, paragraph 11 of the instant Office Action, claims 27-44, 48-49 and 54-55 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Richards et al. “Optimisation of a Neural Network Model for Calibration of Voltammetric Data,” *Chemometrics and Intelligent Laboratory Systems*, 61, 2002, p. 35-49 (“Richards”) in view of Applicant’s admission of prior art. The Examiner is of the opinion that the claims are obvious in view of Richards and admitted prior art. Applicant respectfully traverses the rejection.

Applicant's invention is directed to a process for producing a calibration data set to predict the amount of target constituent in an electrolyte solution, said process comprising: (a) providing a multi-component electrolyte solution comprising constituents which possess different electrochemical properties, said constituents being present in the electrolyte solution at concentrations significantly different from each other, said constituents interacting electrochemically with each other in the electrolyte solution; (b) obtaining a sample set, wherein each sample of the sample set comprises an electrolyte solution of step (a) with known composition; (c) obtaining an electroanalytical response for each said sample to produce an electroanalytical response data set; (d) obtaining a training set that comprises said sample set and corresponding said electroanalytical response data set; (e) preprocessing of training set; (f) determining the calibration range; (g) detecting and eliminating outliers from the response data set; (h) determining the optimal number of factors; (i) detecting and eliminating outliers within training set; (j) analyzing training set using multivariate regression to produce a regression set; (k) validating said regression set to produce a predictive set for a predictive calibration model.

Richards does not meet the showings required for a *prima facie* case of obviousness, defined in section VI above, and the references admitted by Applicant fail to cure the deficiencies of Richards. Neither Richards nor any of the admitted references teach or suggest applying the claimed chemometric method to electrolyte solution (a) in amended independent claim 27, or applying the claimed chemometric method to corresponding electrolyte solution (a1) in amended independent claim 54. Therefore, the references in combination do not teach or suggest each and every element of the independent and dependent claims.

Even if the combination of references cited by the Examiner did teach each and

every element of the rejected claims, none of the cited references provide motivation to apply their disclosed chemometric methods for producing a calibration/predictive data set to as complex a substrate as the claimed electrolyte solution. Richards utilizes as model systems mixtures of components that possess similar electrochemical properties, are present at similar concentrations, and do not interact with each other. The electroanalytical signals of Richards' solution components are independent from each other, and thus are additive, i.e. the algebraic sum of individual voltammograms can recreate a voltammogram obtained from the mixture of constituents. Richards is directed to removing interference, caused by the overlapping signals of other components, from the electroanalytical signal of interest, in a solution where the components do not chemically interact with each other. Therefore, one skilled in the art would not look with any expectation of success to Richards for a method to predict the amount of a target constituent in electrolyte solutions containing interacting constituents of different chemical natures present at concentration levels that differ by several orders of magnitude. The interference in electroanalytical signals from such solutions is not caused by overlapping independent signals, but by systematic matrix effects from physical and chemical interactions between the analyte and other constituents in solution.

Richards in no way suggests the desirability of using the described neural network model to calibrate voltammetric data acquired from anything other than simple mixtures of aliphatic compounds. Neither does Richards motivate a skilled artisan to combine teachings with those of the admitted references. Richards controls for errors in calibration by optimizing the number of training epochs, network inputs, and number of neurons in the hidden layer. Richards does not suggest the desirability of controlling for errors by using a step of detection and elimination of outlier in statistical data sets, as disclosed in references L50-L59, nor do references L50-L59 suggest the desirability of applying detection and elimination of outliers to the method of Richards to arrive at the process of independent claim 27 or its dependent claims. Similarly, neither Richards nor

reference [15] suggest the desirability to combine teachings to arrive at the method of claim 48, which incorporates the subject matter of claim 27 and includes specific methods for outlier detection. Also, neither Richards nor references [1] and [2] suggest the desirability of combining teachings to arrive at the process of claims 38 and 39.

Regarding claim 40, Applicant introduces a novel and non-obvious method of determining the calibration range of a voltammogram by coupling SIMCA-based modeling power and univariate least squares. In reference [1], the author uses whole voltammograms having distinctly developed (although somewhat overlapping) peaks/waves. Applicant's method can use AC voltammetric curves which do not have distinctly developed peaks/waves. Optimization of the range of the voltammogram taken for calibration calculation is an important step to increase robustness of the calibration. It allows selection of regions of voltammograms that are not intuitively obvious (not visually distinct as having peaks/waves), and introduces an objective way of selecting the ranges of highest correlation and highest signal/noise ratio. The claimed method selects the best range (or ranges) in a fully quantitative, independent way, free of human subjectivity. The claimed method is neither taught by the combination of Richards and reference [1], nor do the references provide motivation to combine their teachings with an expectation of success to arrive at the subject matter of claim 40.

Regarding claims 42-44, references [1, 2, 4, 12-15] do not suggest the desirability to combine the disclosed methods for determining the optimal number of factors for calibration with the teachings of Richards. Neither Richards nor the references teach or suggest applying PRESS analysis, including PCR or PLS calculations, to electrolyte solutions containing physically and chemically interacting constituents of different chemical natures present at concentration levels that differ by several orders of magnitude.

Regarding claims 54 and 55, references L44-L47, [19] and [20] do not suggest the desirability to combine the disclosed methods for calibration transfer with the teachings of Richards. Neither Richards nor the references teach or suggest applying calibration transfer to instruments monitoring electrolyte solutions containing physically and chemically interacting constituents of different chemical natures present at concentration levels that differ by several orders of magnitude. “The mere fact that the prior art could be modified in the manner proposed by the examiner would not have made the modification obvious unless the prior art suggested the desirability of the modification.”

Ex parte Dussaud, 7 USPQ2d 1818, 1820 (Bd. Pat. App. & Int’f 1988).

For the above reasons, neither Richards nor the admitted references teach all of the claim limitations, nor do they provide motivation to combine teachings with a reasonable expectation of success. Therefore, a *prima facie* case of obviousness cannot be made. Accordingly, Applicant respectfully requests withdrawal of the 35 U.S.C. § 103(a) rejection and allowance of claims 27-44, 48-49 and 54-55.

VIII. Claims 50-52 are Not Obvious over Richards et al. in view of Applicant’s admission of prior art and further in view of Schneider

On page 8, paragraph 12 of the instant Office Action, claims 50-52 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Richards et al. “Optimisation of a Neural Network Model for Calibration of Voltammetric Data,” *Chemometrics and Intelligent Laboratory Systems*, 61, 2002, p. 35-49 (“Richards”) and Applicant’s admission of prior art and further in view of Schneider

(<http://www.cs.cmu.edu/~schneide/tut5/node42.html>).

The Examiner is of the opinion that the claims are obvious in view of Richards, admitted

prior art, and Schneider. Applicant respectfully traverses the rejection.

The Examiner contends that it would be obvious to combine Schneider's cross validation method with the teachings of Richards and admitted references to arrive at the subject matter of claims 50-52. However, above in section VII, Applicant has already distinguished Richards and admitted references from independent claim 27, from which claims 50-52 depend. The Examiner admits that Richards and admitted references do not teach internal validation by cross validation. Schneider fails to cure the deficiencies of Richards and the admitted references. Schneider does not teach application of his cross validation method to electrolyte solutions containing physically and chemically interacting constituents of different chemical natures present at concentration levels that differ by several orders of magnitude. Even if the combination of references did teach all the claim limitations, Schneider does not suggest or provide motivation to combine his cross validation method with the teachings of Richards or admitted references with any expectation of success. Nor do Richards and admitted references provide any motivation to use internal validation by cross validation. The Examiner "cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention." *In re Fine*, 837 F.2d 1071, 1075, 5 USPQ2d 1780, 1783 (Fed. Cir. 1988).

Richards, admitted references and Schneider cannot support a *prima facie* case of obviousness, because the cited art do not provide suggestion or motivation to modify the reference with a reasonable expectation of success, nor do they in combination teach or suggest all the claim limitations. Accordingly, Applicant respectfully requests withdrawal of the 35 U.S.C. § 103(a) rejection and allowance of claims 50-52.

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IX. Conclusion

In view of the forgoing amendments and remarks, pending claims 1-3, 16-17, 19-24, 27-44 and 48-55 are now in condition for allowance, and an indication to that effect from the Examiner is respectfully requested.

EXTENSION OF TIME

Applicant hereby requests a two-month extension of time for this submission. The original filing deadline was April 3, 2006. The extended deadline is June 5, 2006, as June 3 is a Saturday.

FEE AUTHORIZATION

Please charge all fees due in connection with this filing to our Deposit Account No. 19-0733.

Respectfully submitted,

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